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Effects of Stocking Density on Survival of
Laboratory Cultured Summer Flounder
'Paralichthys dentatus' Larvae

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16. ABSTRACT

Studies are being conducted to determine standard laboratory culture conditions for rearing summer flounder larvae to be used in toxicological bioassays. Experiments were conducted using the type of container and physical conditions use in the long term chronic toxicological bioassays. Possible causes of increased mortality and developmental abnormalities at increasing stocking densities are discussed. Optimum density in the 6 liter closed system was about 20 fish per liter.

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EFFECTS OF STOCKING DENSITY ON SURVIVAL OF LABORATORY CULTURED SUMMER FLOUNDER (*PARALICHTHYS DENTATUS*) LARVAE

GRACE KLEIN-MACPHEE

U. S. Environmental Protection Agency,
Environmental Research Laboratory,
Narragansett, Rhode Island 02882, USA

INTRODUCTION

Studies are being conducted to determine standard laboratory culture conditions for rearing summer flounder larvae to be used in toxicological bioassays. Houde (1977) and Shelbourne et al. (1963) have shown that stocking density affects growth and development of laboratory reared flatfish larvae. Preliminary experiments with winter flounder (*Pseudopleuronectes americanus*) and summer flounder showed that survival and normal development were affected by stocking density, and the manner in which they were affected differed with the size of rearing containers, water supply method (static or flow-through), and developmental stage of the fish. Therefore, an experiment was conducted using the type of container and physical conditions used in long term chronic toxicological bioassays.

METHODS AND RESULTS

Adult summer flounder caught in Narragansett Bay by otter trawl were maintained in the laboratory in an 8 ft (24 m) diameter tank supplied with running seawater at ambient temperatures and salinity. Adults were induced to spawn by hormone treatment after the method of Smigielski (1975). The pelagic eggs were incubated in acrylic hatching jars (Fig. 1) supplied with running seawater at ambient temperatures and salinity. Newly hatched larvae were transferred to black plastic rearing pans (34 × 29.5 × 1.5 cm) containing 6 liters of filtered (0.454 μ Gelman¹ filter) ultra-violet treated seawater at 30 ‰ salinity. The pans were placed in a temperature control box set at

¹Mention of specific brand names does not denote endorsement by the United States Environmental Protection Agency.

15°C with a 12 h light, 12 h dark photoperiod. The larvae were fed a 1:1 mixture dry weight of wild plankton and laboratory cultured rotifers *Brachionus plicatilis* (approximate size of organisms 45-100 microns, numbers 5000/l). There was always an excess

WATER FLOW

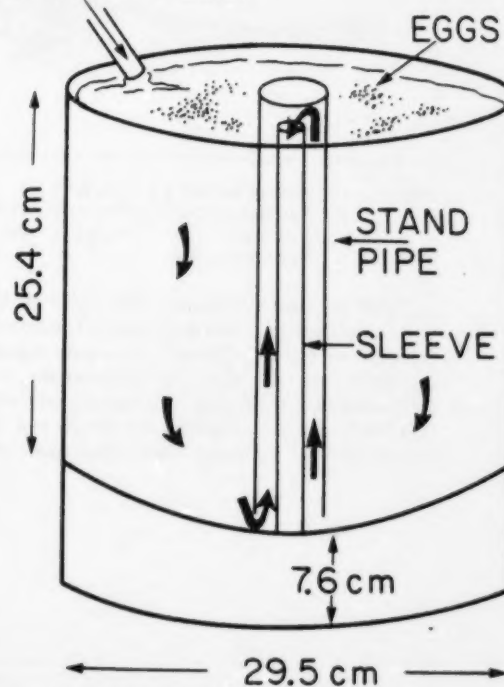


Figure 1. Hatching jar for summer flounder eggs.

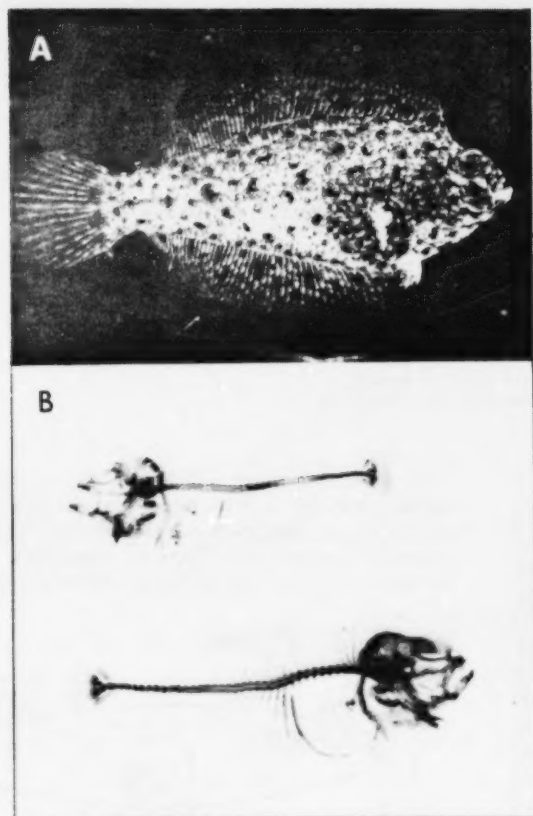


Figure 2. A. Normal juvenile winter flounder
B. Reversed juvenile flounder stained with Alizarin red bone stain. (Top— Reversed flounder; Bottom— Normal flounder).

of food in each container. One third of the water volume of each pan was siphoned off twice a week and replaced with clean, filtered UV treated seawater. One hundred ml of the phytoplankton *Dunaliella tertiolecta* (1.6×10^6 cells/ml) was added daily to each treatment as a tank conditioner. At the end of 30 days the larvae were counted. There were two replicates of

each treatment. Stocking densities were 5, 10, 20, 40, and 80 fish per liter. Mean survival percentages were 0, 11.8, 37.4, 0.9, and 0.6 respectively.

DISCUSSION

The optimum stocking density in 6 liter closed system culture was about 20 fish per liter for summer flounder. Poor survival at low stocking densities may be a result of chance since an average of 30% survival under the best conditions leaves few fish at stocking densities of 5 and 10/l. Preliminary experiments in 30 liter flow-through systems gave best results at 10/l and these fish were not subjected to handling which often causes accidental deaths. It may also mean that feeding behaviour needs reinforcement (seeing other fish feeding) in the early stages. Mortality at high stocking densities may be the result of the build-up of metabolites in the containers or behavioral effects such as aggression.

Overcrowding results in greater mortality during early larval stages; during eye migration and juvenile stages, preliminary experiments with winter flounder showed that it results in a high percentage of structural abnormalities such as loss of pigment, reduction in number of fin rays, hooked dorsal fins, and reversal with the eyes on the left side rather than the right (Fig. 2). These effects have also been observed in lined sole (*Achirus lineatus*) by Houde (1971).

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